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Date JANUARY 27, 1944

Subject Cooling Time for Metal from 105 Bldg.

By W. Q. Smith

To W. C. Kay

MUC No.

Those Eligible To Read The Attached

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W. C. Kay

Central File 11-11-44

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CLINTON LABORATORIES

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DATE January 27, 1944

TO W. C. Kay

DEPARTMENT

FROM W. Q. Smith

DEPARTMENT

IN RE: Cooling Time for Metal from 105 Bldg.

The minimum cooling time for metal from 105 ~~Bldg. before processing~~ in 205 Bldg. depends on the conditions which must be met. Thus, to reproduce most closely the distribution of by-product activity that will be encountered at Hanford, the cooling time should be 60 days. In order to be able to safely handle in the laboratory the product turned out from Room D, the cooling time should be at least 36 days. If the limit is set on the basis that 93 must not interfere with the determination of a gamma decontamination factor of 10^5, then 40 days cooling time is required (assuming the 93 decontaminates by a factor of 10).

A 40-day cooling time would be adequate except that this does not duplicate Hanford conditions of 60 days. In weighing the disadvantages of decreasing the cooling time from 60 to 40 days as far as demonstration of Hanford decontamination factors is concerned, the effect of the decay of specific elements must be considered because if all elements decontaminated by the same factor, then the gross decontamination factor obtained with 40-day old material would be the same as with 60-day material. The greatest differences between 40 and 60-day cooling would be obtained if one element decontaminated so much poorer than the rest that it was responsible for all of the activity after a given amount of processing.

By assuming that a given element is entirely responsible for failure to decontaminate, it is possible to calculate what specific decontamination factor must be obtained for this element to obtain a given gross factor. From this specific factor for the bad actor it is possible to predict what gross factor would be obtained at a different decay period if this bad actor were still the one controlling the decontamination. The principal gamma emitters have been treated in this manner and the results given in Table I.

From this above table, the 2.4 h I from 77 h Te makes up such a small fraction of the total activity at 40 days that the Te can decontaminate by a factor of only 14 and be responsible for a gross factor of 10^5. This is an unreasonably low specific decontamination when all other elements are decontaminated by more than 10^5. The 8 d I must decontaminate by only 600 against a gross of 10^5 and this again looks low. However, in this case, the gross factor at 60 days would be only 4.1 times the factor at 40 days. The specific factor for the La-Ba chain would be 6000 at a gross factor of 10^5 which is not unreasonable. In this case, the gross factor at 60 days would be higher than the 40 day factor by only 2.3. The 60 day gross factors could be lower than the 40 day factors if the longer than average lived elements were controlling. The most extreme case in this direction is the 35 d Cb - 60 d Zr chain which might result in a factor at 60 days of .82 of the 40 day figure.

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Summarizing, decontamination factors determined at 40 days might be lower than the 60 day factors by about 2 if the lanthanum - barium chain is controlling. Otherwise, the results at 40 days and 60 days would be in very close agreement.

Note:

The above treatment is not rigorous because it was calculated from the total activity (beta plus gamma) for the gamma emitters rather than from the gamma activity alone. This does not invalidate the conclusions, however. The data on the various activities were obtained from CN-528 and CC-829. The assumed conditions for the pile operation are 1000 KW operated for 100 days.

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TABLE I.

Element Which is Responsible for Failure to Decontaminate	Assumed Gross Decontamination Obtained at 40 Days	Specific Factor for Element Failing to Decontaminate	Gross Factor Predicted at 60 Days Due to Decay at Specific Element and Gross Decay of Starting Material
93	10^4 10^5	1.0 10.0	290×10^4 290×10^5
77 h Te → 2.4 h I	10^4 10^5	1.4 14	30×10^4 30×10^5
8 d I	10^4 10^5	60 600	4.1×10^4 4.1×10^5
40 h La (12.5 d Ba)	10^4 10^5	600 6000	2.3×10^4 2.3×10^5
30 d Ru) 00 d Ru)	10^4 10^5	870 8700	1.1×10^4 1.1×10^5
60 d Zr	10^4 10^5	990 9900	$.95 \times 10^4$ $.95 \times 10^5$
35 d Cb (60 d Zr)	10^4 10^5	1100 11000	$.82 \times 10^4$ $.82 \times 10^5$